Space Weather Technical Forecast

Issued on Tuesday, 11 January 2022 at 13:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Increasing risk of moderate solar activity.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was low with one C1.0 flare observed from the plage region close to the southeast limb at 11/0837UTC. There are four classified sunspot regions on the visible disc, with the largest and most mature of these AR2924 (Eko/Beta) showing limited activity. AR2926 (Cro/Beta) in the northwest quadrant is a re-emergence of a previous region, but has also demonstrated limited activity. AR2925 an AR2927 are both inactive and currently stable Hsx/Alpha regions. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds speeds at L1 have been slightly elevated under the fast wind of CH43, fitfully easing from around 450 km/s to around 410 km/s with density around average. Total interplanetary magnetic field (IMF) strength, Bt, was weak, with the Bz component also varying weakly. Phi angle was predominantly negative (towards the Sun), with a brief orientation into the positive direction between 10/2100UTC and 11/0400UTC. Geomagnetic activity was Quiet to Unsettled.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at Background levels throughout. High energy electron flux (greater than 2MeV) was at background levels throughout. Electron fluence remained steady and well below the Active threshold (1e8 integrated pfu), with 1.43e6 integrated pfu recorded at 10/2359 UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to remain mainly low or very low, but with an increasing risk of moderate activity as further active regions are forecast to rotate onto the Earth-facing side of the Sun.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Slightly elevated solar winds are expected to decline towards background through 11 and 12 January as the effects of coronal hole 43 wane. The high speed stream from coronal hole 44 is then expected to connect with the Earth on 15 January at the earliest, beyond the end of the forecast period. Quiet to Unsettled geomagnetic activity is expected through the next four days.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is forecast to remain at background levels. The high energy electron flux (greater than 2MeV) is likely to increase through this period, perhaps reaching high levels on days 13 and 14 January. Electron fluence is expected to remain below the Active (1e8 integrated pfu) threshold, but with a rising trend later in the period.

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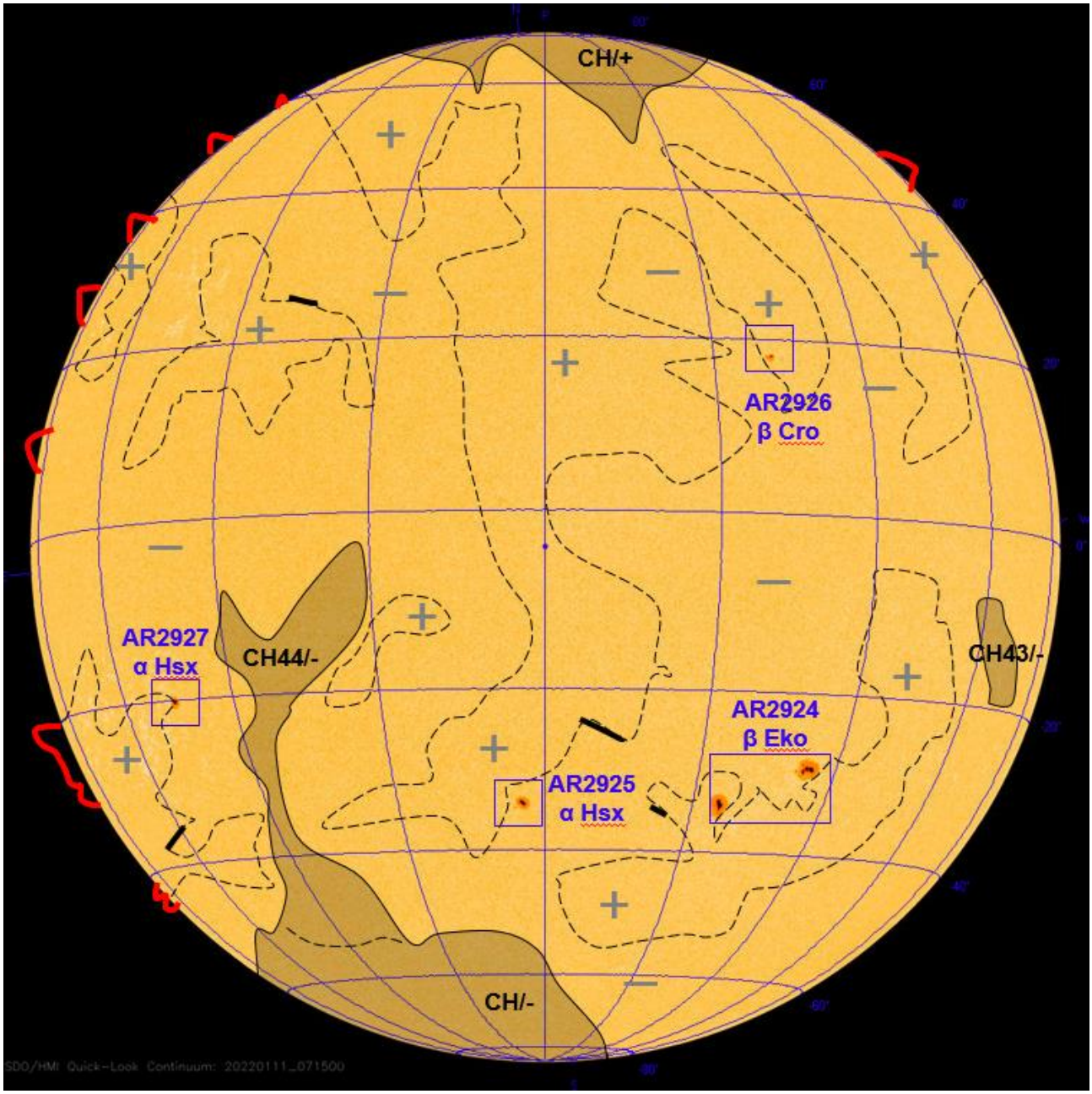
Figure 1. Solar Analysis Valid 11/0800UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs in the forecast.

Solar wind speeds are expected to continue to decline through 11 and 12 January as coronal hole 43 rotates towards the western limb. The high speed stream from coronal hole 44 is then expected to connect with the Earth, either late on 15 January or early on 16 January, based on speeds of between 500-600km/s. As these dates are beyond the end of the forecast period, speeds are expected to be background or slightly elevated levels through the next four days.

Geomagnetic activity is expected to be mainly Quiet to Unsettled through the next four days.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected

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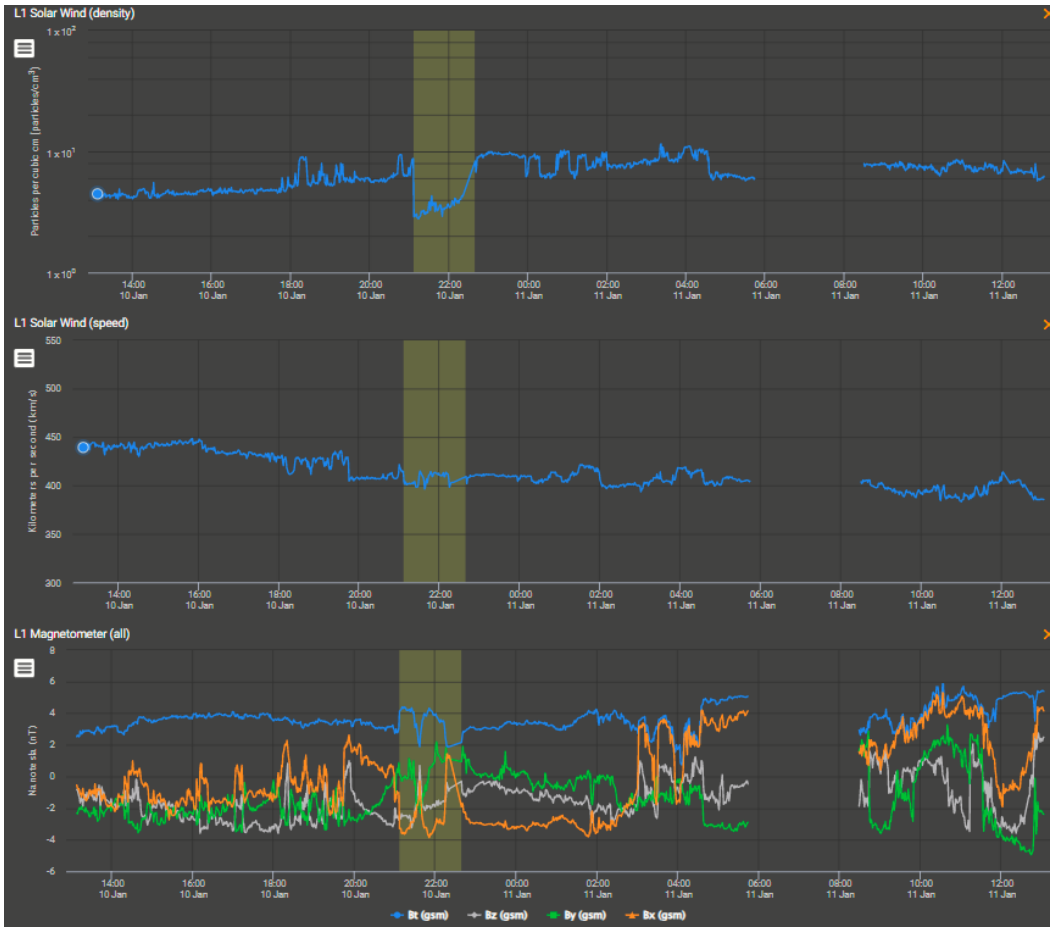
Figure 2: L1 solar wind parameters for the previous 24 hours.



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Radio Blackouts - X-Ray Flares:
Solar activity has been low, with one observed C-class flare in the last 24 hours. There are four active regions on the visible disc, with AR2924 (Eko/Beta) in the southwest quadrant the largest and most mature of these. This region presents the highest flare risk, but has not produced any recent significant activity. AR2926 (Cro/Beta) and AR2925 (Hsx/Alpha) are also small and relatively inactive. AR2927 (Hsx/Alpha) is adjacent to a large plage region which was responsible for the sole C-class flare of the last 24 hours, with a significant level of magnetic flux apparent on STEREO A EUVI imagery. There is also a large plage complex in the northeast quadrant that has the potential for sunspot development.

In addition to the observable active regions, STEREO A EUVI imagery and persistence suggests that a number of active regions are due to rotate onto the Earth-facing side of the Sun during the next four days, with an increasing risk of low or moderate solar activity by the end of the forecast period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	15	20	20
Very Active	R3 to R5 X Class	No	1	2	2	2

Figure 3: SDO HMI intensitygram and magnetogram imagery of AR2924 at 11/1230UTC.

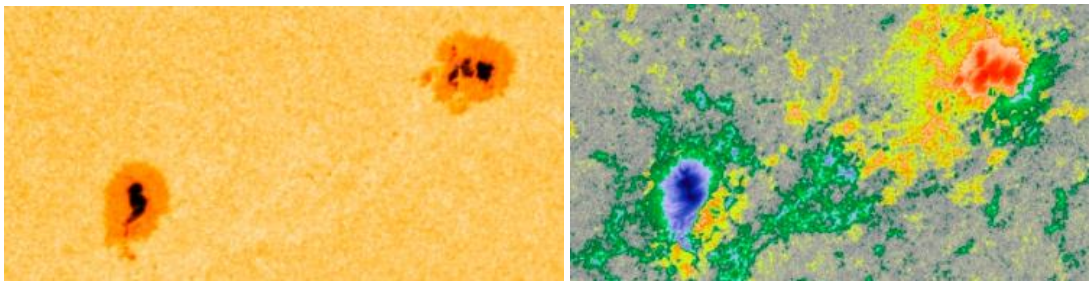

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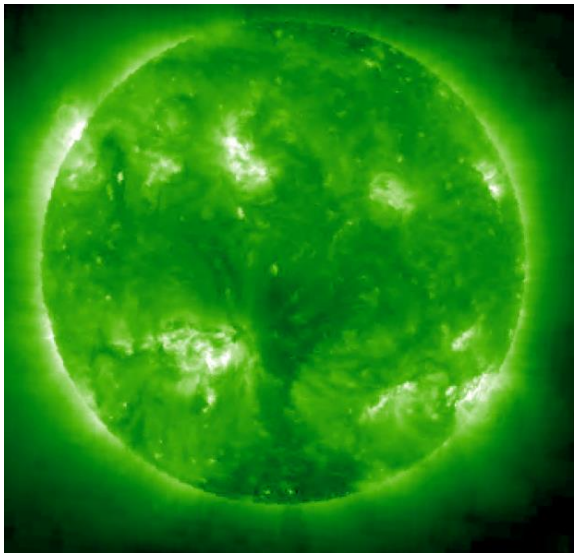
Figure 4: STEREO A EUVI imagery from 11/1245UTC. The bright areas on the left limb are due to rotate onto the Earth-facing disc through the forecast period and have a history of producing CMEs while on the far side of the Sun.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is currently at background levels and will most likely persist at this level in the absence of solar activity.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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High Energy Electrons Event (≥ 2MeV):
The high energy electron flux (greater than 2MeV) has been at background levels, but is expected to steadily increase on diurnal maximum from 12 January as the high speed stream from coronal hole 43 declines. This may result in exceeding the high (1e3pfu) threshold on 13 and 14 January.

Electron fluence values are well below the Active (1e8 integrated pfu) threshold. These are expected to remain below the threshold, but with a rising trend later in the period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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